Ref # 137

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UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

FOREST INSECT CONDITIONS WITHIN THE GLACIER NATIONAL PARK WITH RECOMMENDATIONS FOR CONTROL 1930

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November 10, 1930.

U. S. GOVERNMENT PRINTING OFFICE: 1930 J 76138

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1930

GLACIER NATIONAL PARK

INTRODUCTION

This report has been prepared for the purpose of depicting existing forest insect conditions within Glacier National Park as revealed from an examination by the writer, and to offer recommendations for their control. Detailed descriptions and discussions have been given in order that the rather complicating factors peculiar to problems of this character can be more clearly understood.

Epidemics of forest insects within our National Parks present a more difficult task for solution than those which exist within our National or privately-owned commercial forests. When commercial forests are involved it is not only possible to set a value upon the timber, but the time that the product will be harvested also establishes the length of time protection will be necessary. With these data it is possible to determine rather accurately the economics of control for epidemics occurring within such forests.

Insect epidemics within the scenic forests of our National Parks present a problem often having very difficult economic as well as entomological angles to be solved. It is difficult, if not nearly impossible, to measure the intangible value of a scenic forest, used as are the forests of Glacier National Park, as a frame for the grandeur of the Rocky Mountains. The difficulty of the entomological problem

within these forests is the task of preserving the trees through countless ages so that generations to come may enjoy happiness from their beauty. Each year the task becomes more difficult as the increased age and decadence of the trees make them more susceptible to the attacks of insects and disease.

The writer does not desire nor does he believe that his recommendations relative to the action to be taken in regard to these problems should be accepted without question. An attempt has been made to present all phases of the problems so that the agency charged with the protection of these timber stands can visualize the complicating factors involved as well as the seriousness of the situation, and either approve or reject the recommendations that are offered. Though the writer's reaction as to the entomological needs of each problem has been presented, such requirements must of necessity be balanced against the other factors mentioned before a decision as to the justification of control can be rendered.

HISTORY OF CONTROL IN GLACIER PARK

Rather meager records of the Bureau of Entomology show that in 1911 approximately 1100 white pine trees infested with the mountain pine beetle were treated in some area on the west side of Glacier Park. It is believed that this work was conducted in the timber stands surrounding McDonald Lake. Records show that this project was successful, and though this is undoubtedly true for the area covered, one can be sure from the evidence now existing that other areas seriously infested at that time were not considered in the plan of operation.

Again in 1930 artificial control measures were instituted for the suppression of an outbreak of the mountain pine beetle (Dendroctonus monticolae) in some of the white pine stands of the Glacier Park. Projects were conducted in the McDonald-Mineral Creek Basin, and along the trail to Sperry Glacier and Fish Lake. In the McDonald-Mineral Creek basin some 363 infested white pine trees were treated at a total cost of $1,573.36 or $4.33 per tree. Along the trail to Sperry Glacier and around Fish Lake some 1,116 infested white pine and lodgepole pine trees were treated at a cost of $2,405, or $2.15 per tree. These figures show a total expenditure of $3,978.36, covering the treatment of 1,479 trees at an average cost for both white pine and lodgepole pine of $2.69. These cost data are indeed very satisfactory, and an inspection of the control work during the past summer shows that the work was very thoroughly performed. The writer wishes to commend the Park officers in charge of these projects for the enthusiastic and efficient manner in which they attacked this problem.

STATUS OF 1930 INFESTATION AND RECOMMENDATIONS FOR CONTROL

During the latter part of August the writer spent ten days on an extensive examination of known insect-infested areas on the west side of Glacier National Park. Messrs. Coffman and Croghan, officers of the National Park Service, accompanied the writer for the first two days of this examination, but at that time they were withdrawn to assist in the suppression of a severe forest fire. Later in September additional data were secured by Ranger Croghan relative to conditions within the lodgepole pine stands along the North Fork of the Flathead River, and from the Nyack District by Ranger Harkins. In the preparation of this report all available information has been used.

A decision as to the need for the institution of artificial control measures to suppress destructive barkbeetle outbreaks would seem to be a rather simple one to reach. This is no doubt true if only the entomological angles of such problems are to be considered. It can be safely assumed that all outbreaks of insects that are destroying valuable property of any character should be reduced through the institution of artificial control measures, if such devastation is to be brought to an end, and the epidemic prevented from spreading into other and perhaps more valuable areas. However, there are factors aside from those of an entomological nature that must be considered in all recommendations. The control of barkbeetle epidemics is an expensive and laborious task. The success of such operations depends largely upon the quality of work performed and the scope of the project. Therefore, in addition to the need

for large appropriations, the requirements of personnel trained in administration of such work is a factor that must receive serious consideration. In addition to the factors of funds and administrative personnel, there is also an economical angle to all contemplated projects. As stated, the determination of the economics of insect control within commercial forests becomes a relatively simple task. Through the appraisal of a stand one can fairly accurately determine the funds that can be economically spent for insect control until such a time as the timber is harvested. With forests within our National Parks, that must of a necessity be measured for their scenic value alone, the task is far more difficult. Not only is the loss that can be credited to the depredation of a barkbeetle outbreak in such forests an intangible one, but the task of preserving such forests for generation after generation is practically an impossible undertaking. As maturity is reached forests rapidly become decadent, with the subsequent lowering of their resistance to the attacks of insects and disease. Though an epidemic occurring in such a forest may be reduced by artificial control, the threat of a recurrence of such a condition becomes more severe as time goes on.

In the adoption of a policy of insect control for forests of scenic value only, it would seem that the ideal to be sought is the development of a condition that would permit a gradual transition from the old overmature forest to one of more thrifty growing trees. Such a policy would permit the presence of what is called a normal infestation, through which the old, overmature trees would be removed and an

opening provided for more thrifty, resistant individuals. If such an infestation could be maintained within a forested area for a sufficient length of time, an uneven-aged, mixed forest would result that would satisfy the scenic demands made upon it for all time to come. However, to accept a normal infestation within an area is to perhaps invite at some time the development of a destructive epidemic destroying a large per cent of the timber in a few years. The occurrence of such conditions should be prevented through careful observation of the area and the institution of control as soon as any indication of such a development is noted. From a consideration of all such factors it is evident that before the institution of control one must look carefully into all insect problems occurring within our National Parks in order to determine the results, either temporary or permanent, that can be expected from such projects, as well as the extent of the loss that will follow if no action is taken, for conditions do occur that make the institution of control an unsound procedure.

The different infestation units will be discussed separately.

McDonald-Mineral Creek Basin

This area lies some 12 miles to the north of Lake McDonald, at the junction of the McDonald and Mineral Creek drainages. It is a narrow valley varying from 1/4 to 1/2 mile in width, and from 1½ to 2 miles in length, bounded by high mountain ridges reaching well above the timber line. This basin is well isolated from other pine forests within the Park, and the high mountain ridges, acting as natural barriers, give it additional protection against an influx of insects.

The forest cover is the usual mixed stand of white pine, lodgepole pine, Engelmann spruce, white fir, Douglas fir, larch, etc., that is found throughout this region. It is estimated that white pine comprises about 25 per cent of the present timber volume of the area. Some years ago (1910-1913) a severe outbreak of the mountain pine beetle destroyed a large per cent of the total white pine volume, the old snags still remaining as mute evidence of this devastation. There is an excellent stand of reproduction on the area, though white pine constitutes but a small per cent of it.

A severe outbreak of the mountain pine beetle in white pine was reported from this basin in 1929. Control measures were instituted in May, 1930, and 363 trees treated by felling and removing the bark from the infested portion of the bole. The location of the infested trees, as well as the actual treating, was very well performed, as during the writer's examination of this area in August only one tree was found that had not been treated, and that one had been marked by the spotters.

On August 20, Mr. Coffman and the writer spent several hours in this area; however, a great deal was not accomplished, as a severe storm prevented field work. Though a large number of green white pine were examined at that time, only one 1930 attack was found. On August 26, the writer again visited the area and ran 460 chains of sample strip one chain in width. Only two newly-attacked trees were recorded, which gives but .04 trees per acre. These data applied to the acreage of the area, or 640 acres, shows a total of 25 newly-attacked trees or a reduction of 93 per cent over the number of trees treated. It is believed that this figure will prove to be fairly conservative as in running the sample strip the course was deflected whenever feasible so that as many groups of green white pine as possible could be visited. Such action gives an inflated value to the number of newly-attacked trees per acre.

The success of this operation should be safeguarded by maintenance control in the spring of 1931, for the purpose of preventing the existing 25-35 infested trees from developing into a recurrence of the condition which existed with the 1929 attack. Due to the isolation of this area it can be expected that the results secured will not be influenced through an influx of beetles from other infestations. It is therefore recommended that all pine trees within this area that are infested with the mountain pine beetle be treated in the spring of 1931. An allotment of $200 should be made to provide for the treatment of these trees.

Sperry Glacier Trail and Fish Lake

This area lies east of the head of Lake McDonald, and is situated on the lower elevations of the steep mountain slopes leading to the Continental Divide. Throughout this region there are several small benches but in general the terrain is very rough and steep. The forest cover is a mixed type of white pine, lodgepole pine, larch, Douglas fir, spruce, hemlock, alpine fir, and cedar. It is rather difficult to select the predominating species, as the type changes very rapidly and one moves quickly from one mixture into another. Some years ago there was a heavy loss in the pine stands during an outbreak of the mountain pine beetle that occurred from 1911 to 1913. The standing snags give ample evidence of this destruction. There are also many old decaying logs upon the ground, indicating that there had been heavy insect losses prior to the epidemic of 1912. It would seem that these stands are rapidly reverting from a temporary pine type to a climax forest of fir, spruce, larch and hemlock.

In the spring of 1930 control measures were directed against an outbreak of the mountain pine beetle working in the remaining lodgepole pine and white pine stands of the area. At this time some 1,116 infested trees were treated at a total cost of $2,405, or $2.15 per tree. This shows a lower cost per tree than was secured from the McDonald-Mineral Creek Basin area, but in this unit a large per cent of the treated trees were lodgepole pine, with a smaller amount of infested bark surface to be removed. The treating was very thorough and on the areas covered by control and spotting had been well performed, though a scarcity of funds

did not permit the operation to extend to the limits of the infested area.

On August 22 the writer accompanied by Ranger Croghan examined this area, running some 4½ miles of sample strip that gave an average of .94 trees per acre. The heaviest infestation was found along the first mile of the Sperry Glacier trail and between the Sperry trail and Fish Lake. In applying the data secured from this survey to the area being considered difficulty was experienced, as the total timbered acreage is not accurately known. However, it is estimated that there are perhaps some 450 acres to which these data should be applied. This would give a total of 423 trees attacked in 1930, or a reduction of 62 per cent from the number of trees treated. However, the percentage of reduction should no doubt be larger than that given, as there were more infested trees on the area than actually treated.

Though this area is described as the Sperry Glacier Trail-Fish Lake unit, it extends southward along the west shore of Lake McDonald for several miles. In planning for control, this entire type should perhaps be considered as an infestation unit if the most satisfactory results are to be secured. However, to the southwest of Fish Lake there is a low percentage of white pine with light infestation. The forest is of a decidedly mixed type, with the pine forming but a rather small per cent of the stand. There are unfortunately some groups of both lodgepole pine and white pine lying along the first mile of the Sperry Trail that are rather heavily infested. The infestation of 1929 with the existing 1930 attack has already destroyed a large per cent of the trees of these groups, and it would seem that every possible effort should be made to protect the scenic value of this popular trail.

However, in considering the loss of the pine throughout this unit, it is evident that when dealing with such mixed forest types the removal of any one species would result in no serious damage to the scenic values. The institution of control throughout this region would be an exceedingly expensive undertaking. The pine is scattered throughout the stand so that a 100 per cent survey would be necessary if all the infested trees are to be located in order to bring about a thorough clean-up of the infestation. The nature of the terrain and the ground cover would make a spotting survey of this character a slow and expensive operation.

As an infestation exists within this forest that is above a normal condition, one must say that from an entomological viewpoint control measures should be instituted in 1931 for the protection of the remaining pine stands. However, it is doubted if the scenic value of the pine would justify the institution of a program of control over the entire area. To the south of Fish Lake the pine becomes more scattered and the infestation much lighter. Though, as stated, all of this area should be considered as a unit, it is believed that the pine does not exist in such quantities as to constitute a serious menace through reinfestation to any results secured by control along the Sperry Trail and Fish Lake. It is therefore recommended that in 1931 a continuation of the control operation instituted in 1930 be confined to the 450-550 acres of pine timber lying along the Sperry Glacier Trail and around Fish Lake, for the purpose of protecting the results already secured. The sum of $1,300 should be allotted for the purpose of treating the 450-500 infested trees that are present on this area.

Spruce Creek Area

This area lies some six miles to the north of Belton, and is a part of the Fish Creek drainage, a tributary of Lake McDonald. It is a small drainage with steep mountain sides, and the forest floor a tangle of logs and underbrush. There are approximately 450 acres of white pine type, practically surrounded by the 1926 burn. Engelmann spruce, larch, and fir, with lodgepole pine at the higher elevations, are in association with the white pine of this forest.

A mountain pine beetle outbreak has developed very rapidly in this area during the past few years. There were a few trees attacked in 1928, but as previously reported the loss resulting from the 1929 attack was the heaviest white pine infestation the writer has ever seen. This serious situation was examined in September 1929, and reported upon by Mr. DeLeon in his report of November 15, 1929. It is regretted that due to inadequate data relative to the timbered acreage of this area Mr. DeLeon's estimate of the number of infested trees proved too conservative, and funds were not available for control in 1930. On August 21 an examination was made of this area by the writer, who was assisted by Messrs. Coffman and Croghan. During this examination 150 chains of sample strip, two chains wide, were run. On this strip of 30 acres there were 202 newly-attacked trees, or 6.7 trees per acre. Applying these data to the timbered acreage of the area, a total of 3,015 newly-attacked trees is secured. This loss with that of the 1929 attack takes from the stand approximately 80 per cent of the white pine.

The remaining volume is not sufficient to justify the institution of control on either a commercial or aesthetic basis. There are in this area some 3,000 infested trees that would require an expenditure for treatment of $13,500. It is believed that this sum is entirely out of proportion to the scenic values of the remaining white pine. The only justification that can be advanced for the control of the infestation within this unit is to prevent its probable spread into other areas. Another year and practically all of the white pine will be destroyed, so it is logical to assume that when this occurs there will be a heavy migration of the insects in some directions. Though a serious epidemic exists, and control measures are necessary if the remaining white pine is to be protected, such action is not recommended, as the writer does not feel that the values at stake would justify such procedure. Its danger as a source of reinfestation to other areas is another matter, and will be considered in the discussion of the North Fork unit. The writer's reaction to this situation should be seriously questioned before being accepted or rejected.

Nyack Region

Accompanied by Ranger Harkins, the writer made an examination of a small body of timber lying at the foot of Harrison Lake.. This body of timber, consisting of approximately 600 acres, is completely surrounded by the 1929 Half-Moon fire. The timber type is the usual mixed stand encountered in this region, with about half of the total acreage being a mixed pine forest. Though there is some white pine, lodgepole comprises the greatest part of the pine volume. There has been a mountain pine beetle infestation in this region for the past three years, and if the loss resulting from the 1930 attack is included, at least 60 per cent, and perhaps more, of the pine has already been destroyed. A strip was run through the pine stand, and a total of 96 newly attacked trees secured. These data give 16 trees per acre, or a total of 4,800 for the area.

Three or four miles to the south of the Nyack Ranger Station an outbreak of the mountain pine beetle that would seem to be above a normal status is present in both white pine and lodgepole pine. As a result of a survey of this area conducted by Ranger Harkins, data were secured indicating that the 1930 attack on lodgepole and white pine averaged .43 of a tree per acre. This figure was secured from 166 acres of sample strip. The writer can find no reference to the acreage of this area in Ranger Harkins' report. However, in a letter transmitting Rangers Croghan's and Harkins' reports, Superintendent Eakin refers to the 1,600 infested pine in this District, so it can be assumed that there are some 3,730 acres that were considered.

No control measures are recommended for the protection of the pine at Harrison Lake. The area is small and seldom, if ever, visited by tourists, which would make the institution of control an unwise procedure. The writer's reaction to the pine infestation to the south of the Nyack Ranger Station is somewhat the same. The pine, constituting but a small per cent of the total volume, is scattered throughout a mixed forest, making the loss of 50-60 per cent of the pine trees of minor importance when the scenic value of the entire area is considered. Park officials estimate that there are some 1,600 infested trees in the area, so an expenditure of $6,000 would be required for this treatment. There are heavy infestations within the pine stands of the South Fork of the Flathead River drainage, and it is possible that these areas would need to be considered in any thoughts of control for this region. From Ranger Harkins' report it is evident that an infestation exists that in severity is above what would be called a normal condition, and when such situations occur control measures should be instituted for the protection of the remaining pine stand. With the full realization that his reaction to this area may be at fault, the writer feels that the importance of the pine stands of this region would not justify such action, and no control is recommended.

North Fork District

From the head of the Fish Creek drainage to the north of Belton, there extends along the North Fork of the Flathead River a rather solid body of timber that reaches to the Canadian border. Along the lower elevations of this drainage there is a continuous stand of lodgepole pine, broken by areas of larch and some small patches of yellow pine. The age of this lodgepole varies from stands of reproduction to mature and overmature types. Extending back into the higher elevations the lodgepole pine gives way to a mixed stand of Douglas fir, alpine fir, larch, hemlock, etc.

On August 27 an examination was made of the forests in the vicinity of the Logging Lake Ranger Station. A sample strip was taken along the north trail leading to Logging Lake. On this 4.5 miles of strip 92 newly attacked lodgepole pine were counted, giving an average of 2.5 trees per acre. From this trail several good views were obtained of the south side of the Logging Creek drainage, and from the number of red-top pine observed it is evident that this outbreak extends over a considerable area. Though from the data secured it was realized that a serious situation existed within this area, it was difficult to make an estimate of the total number of trees infested, as the acreage of the lodgepole pine types were not known.

For the purpose of securing additional information relative to this situation sample strips were run on Dutch Creek and Camas Creek on August 28. The portion of the Dutch Creek drainage covered lies to the east of the road, and is some six miles south of the heavy infestation located on Logging Creek and about the same distance from the severe white pine infestation on Spruce Creek. In this area four miles of sample strip were taken, and but one newly attacked tree located. This attack was not heavy and was on an old, decadent tree. In this area there was nothing to indicate that conditions were anything but in a normal status, though it is realized that but a very small portion of the area was covered, and it is possible that more heavily-infested areas would have been located had a larger sample been secured. Sample strips were taken from that portion of the Camas Creek drainage lying along the North Fork highway. This area is some three miles to the southeast of the area covered on Dutch Creek, and about the same distance from the infestation on Spruce Creek. In this area four miles of sample strip were taken and two groups of newly-attacked trees recorded. In one group of 10 infested trees there were two small red-tops that could not have accounted for the number of new attacks. In the other group of seven infested trees there were no 1929 attacked trees in evidence. These data show an average of .53 newly-attacked trees per acre, representing a rather serious situation. Not being able to secure an idea of the lodgepole acreage of this drainage, it was impossible to make an estimate of the number of trees infested at this time.

The data secured by the writer from these three areas, though ample to indicate the seriousness of the situation, were not sufficient to base an estimate of the total number of infested trees. Furthermore, additional field work was necessary to ascertain the lodgepole pine acreages of these units. Arrangements were therefore made for the detail of Ranger Croghan to the task of making a more intensive survey. Mr. Croghan spent six days on this survey, and though it is believed that more time should have been allowed, the writer feels that the work was carefully performed and the data secured as accurate as could be expected with such a small portion of the area being covered. Some 267 acres, or 33.3 miles of sample strip, were taken. This sample is applied to a total acreage of 39,040 acres, and amounts to .0068 per cent of the total. Mr. Croghan has considered the three ranger districts of this region separately and has subdivided them into smaller units. His description of these districts, with his data, follow:

Report of Insect Infestation Survey
of
Kishenehn, Bowman, Logging Districts
and
Portion of McDonald District lying Northwest of
Lake McDonald comprising the Camas Creek Basin.

Kishenehn District.

The portion of Kishenehn District lying northwest of Kishenehn Creek comprising some 4,480 acres has no infestation other than secondary attacks on injured trees.

The portion between Kishenehn Creek and Kintla Lake extending from the North Fork of the Flathead River to the Canadian border comprising some 6,400 acres has an infestation of .4 tree per acre or 2,640 trees.

The portion lying south of Kintla Lake has for the most part been so badly burned over that a survey is unnecessary so far as Dendroctonus Monticolae are concerned.

Bowman District.

Eliminating a portion lying north of Indian Creek (6,400 acres) this district was divided in three parts.

1st. North of Bowman Creek including basin drained by Indian Creek not excluded on account of fires in former years, extending northeastward from river to limit of lodgepole stand and includes some 6,400 acres with an infestation of .4 tree per acre or 2,560 trees, but as the survey showed the attacks mostly confined to the lower levels, it is possible that estimate is too high.

2nd. South of Bowman Creek to Quartz Creek extending northward from river to limit of stand comprising 9,600 acres has an infestation of .49 trees per acre or 4,704 trees. This stand is all mature timber with a stand of approximately 800 trees per acre. This makes the infestation approximately .0006 per cent of the present mature timber.

3rd. Beginning at Cummings Ranch and extending north six miles between Quartz Creek and top of Quartz Ridge, then east taking in the Quartz Lakes and Cummings Creek basins, comprising 9,600 acres with an average of .26 infested trees per acre or 2,496, which added to No. 2 above makes a total of 7,200 trees in south Bowman district, and a grand total of 9,760 infested trees scattered throughout some 25,600 acres of lodgepole pine timber.

Note: This stand is approximately 50 per cent mature.

Logging District.

1st. The Logging Creek project extends along creek for four miles and is approximately 1/2 mile wide mostly on north side of creek contains 1,280 acres with 2.8 infested trees per acre or 3,584 trees.

2nd. The Anaconda Creek basin project of about three sections extending southward from upper Anaconda basin and is included in the Dutch Creek survey, see below.

3rd. The Dutch Creek project extends from a point approximately two miles west of road 1/2 mile wide for four miles, then widens out extending over into the upper basin of the Anaconda Creek and takes in some 3,840 acres with an infestation of 1.98 trees per acre or 7,603.2 trees infested in this project.

4th. This project lies west of road and south of Dutch Creek and contains about 1,920 acres with an infestation of 1.7 trees per acre or 3,264 trees infested.

The balance of this project lies east of the road between Dutch Creek and Camas Creek extending northeast to limit of lodgepole type and has approximately 5,760 acres of this type of timber, and using Mr. Evenden's figures of .53 tree per acre infested, makes a total of 3,052.8, which added to the above makes some 6,316 infested trees scattered throughout some 7,680 acres of timber.

Respectfully submitted this day, Sept. 19,1930.

(sgd) Charles L. Croghan
Park Ranger
Logging Creek District

To visualize perhaps a trifle more clearly the situation within this territory as revealed from the available data, the following table has been prepared from the strip survey sheets:

Area	Total Acres	Sample Strip	Per Cent Acres	New Attacks per Acre	Red Tops Per Acre	Per Cent increase or decrease	Estimate No. New Attacks
Kishenehn	6400	53.5 A. 6.7 miles	.008	.41	1.36	-69%	2,624
Bowman #1	6400	24 A. 3 miles	.004	.42	1.83	-77	2,688
Bowman #2	9600	59 A. 7.4 miles	.006	.49	1.32	-62	4,704
Bowman #3	9600	47 A. 5.9 miles	.004	.28	.00	--	2,688
Logging District #1	1280	32 A. 4 miles	.025	2.87	--	--	3,673
#2	3840	36 A. 4.5 miles	.009	1.97	--	--	7,564
#3	1920	15 A. 1.8 miles	.007	1.6	--	--	3,072
Area Covered by Evenden, Camas Creek	5760	32 A. 4 miles	.005	.53			3,052
							30,065

It will be noted that there are a few slight differences in these data and the report submitted by Mr. Croghan that are mostly due to an extension of decimals.

As stated, the territory under consideration lies along the east side of the North F ork of the Flathead River drainage. The west side of this drainage, lying within the Blackfoot National Forest, contains stands of lodgepole comparable to those of Glacier Park. In view of our present knowledge it would be an unsound policy to consider either side of this drainage as a separate control unit. In 1929 forest officers of the Blackfoot Forest reported a normal infestation of the mountain pine beetle throughout the lodgepole pine forests of this drainage. An outbreak of this insect in the white pine stands of Canyon Creek was also examined and reported upon by forest officers. In this small area of 3,600 acres of white pine it was estimated that there were 6,100 trees that had been attacked in 1929. The writer visited this region on August 24, and secured five miles of sample strip one chain in width. On this strip 55 newly-attacked trees were located, averaging 2.1 trees per acre, or a total of 7,560 for the area. This is a serious epidemic, and unless checked will result in the destruction of a large per cent of the total volume of white pine.

The decision as to the justification for the institution of control within this region is indeed difficult to make. Before discussing the various factors of this project it would be well to look into the damage that can be expected if no control is instituted. The concern of the project is the destruction of the lodgepole pine forests extending along the North Fork of the Flathead River drainage. The protection of the white pine has been removed from the picture, as the volume remaining is not sufficient to justify any action by itself. Epidemics of mountain pine bettle in lodgepole pine forests remove in five or six years from 50 to 65 per cent of the trees. This includes a large per cent of all trees above 6-8 inches in diameter. Such a destruction causes an unsightly scar for a period of years that is especially true while the discolored foliage remains upon the dead trees. After this foliage has fallen the snags, though still of no decorative value to the forest, permit the green understory of smaller trees to be seen and the scar is fairly well covered. In 10-12 years these snags have practically all fallen to the ground and a green, though sometimes rather sparse, forest cover remains. At that time when viewed from a distance it is difficult for one to visualize the devastation that has occurred. So perhaps we may assume that the scars resulting from an epidemic of this character may be fairly well covered in a 10-15 year period, but the story is not complete, unless one considers the increased fire hazard that is created. With the falling of these countless snags a mass of debris is created, forming a fire hazard that offers the most serious task of fire suppression that can be encountered.

So in considering the seriousness of this potential epidemic we have the thought of the fire hazard lasting for several decades, to balance against the somewhat temporary destruction of the scenic values of the forest.

Though the writer's reaction to that portion of the region covered by him was that an infestation existed that could not be considered as a normal or decreasing infestation, Mr. Creghan shows for the three northern areas a reduction, from the 1929 attack to the 1930, varying from 62 to 77 per cent. These data are confusing, and do not conform to the conditions as encountered by the writer. There are no comments that can be made relative to these data, as it is possible that in this portion of the area such an infestation exists, and the only possible chance of an error is that in the counting of red-tops the basal evidence of some new attacks was overlooked, though such an occurrence is doubted. The writer would be inclined to disregard the red-top data and consider the information relative to the occurrence of new attacks per acre as indicating a condition considerably above a normal infestation.

In planning for the institution of a thorough program of control for this region it would be necessary to include that portion of the Blackfoot National Forest lying within the North Fork of the Flathead River drainage in order to protect the results secured on the Glacier areas. Such action will not only call for

the treatment of lodgepole pine infestations but those existing within the white pine type of Canyon Creek, etc. Though a fair knowledge is available relative to conditions within the white pine stands of the Blackfeet, the extent or seriousness of the infestation in the lodgepole forests is not known at this time.

Within the Park it would also be necessary to cover with control work the area lying opposite the mouth of Canyon Creek, Blackfeet Forest, as well as the Spruce Creek infestation.

To launch a program of control for the protection of the lodgepole forest of the North Fork region, the following expenditures would be necessary:

<u>Glacier National Park</u>

Lodgepole - 30,000 trees @ $1.70	$51,000
White Pine, Spruce Creek, 3,000 trees @ $4.50	13,500

<u>Blackfeet National Forest</u>

Lodgepole - Treating any existing outbreaks	10,000
White pine, Canyon Creek, 7,560 trees @ $4.50	34,020
	$108,520

In the adoption of this plan one must realize that the sum of $108,520 that has been set up as the cost of this project is for the year 1931 only. It is practically impossible to effect a cleanup of such large projects in one season, and the necessity for follow up maintenance control with unknown expenditures is assured. The $10,000 estimate for the Blackfeet lodgepole is set up to care for any situation that may exist at this time, and may prove totally inadequate.

The above outline for this project is a logical one to adopt, and if satisfactory returns from the investment for control are to be assured there should be no departure from it. In justifying the need for control in all of these units, it must be realized that positive statements relative to the future can not be made. One can not say that the insects will spread from white pine to lodgepole, nor can one safely assume that they will move from the Blackfoot to the Park. Though it is known that these insects are capable of long sustained flights, there are no records available where epidemics in white pine have acted as sources of supply for lodgepole pine outbreaks. With this fact before us there are two possibilities to be considered in the institution of control, both containing risks hazardous to the success of the project. These possibilities are: first, that the infestation which now exists within the lodgepole forests of the Park may not develop into serious proportions; and, second, the assumption that the infestation in white pine does not constitute a menace to the lodgepole. With the acceptance of both premises there is no need for the institution of control in either white pine or lodgepole. With the acceptance of one, work should be conducted against the other.

Considering this problem entomologically, control measures should be instituted in the area, and in the adoption of a program of control the writer feels that the entire area should be considered as a unit, and that both the infestation in white pine and lodgepole pine be treated. However, a chance could be taken and consideration given to the lodgepole only in the hope that these white pine outbreaks would not act as a source of reinfestation to the areas covered by control. As stated, such a plan of attack would be a hazardous procedure, but might show satisfactory results, and would surely produce valuable entomological information.

As the North Fork district is the most serious of all the insect problems within the Park, the writer has discussed the situation in considerable detail, trying to bring to the readers of this report a picture of existing conditions and what the future holds if no control work is instituted. The reason for such detailed descriptions and discussions is that the writer has no desire for his recommendations to be taken at their face value, as it is sincerely believed that especially in this situation the final decision should rest upon those responsible for the protection of the forests.

To summarize, it is evident that control should be instituted for the protection of the pine stands of the North Fork; however, in considering the expense, the complicating factors involved, and the difficulties of administration through lack of trained personnel, and the fact that no guarantee of success can be made, etc., the writer's reaction to the situation is that the institution of such a project is not justified.

Logging Lake Douglas Fir Infestation

Along the north side of Logging Lake in a mixed Douglas fir type, there is an epidemic of the Douglas fir beetle in Douglas fir, with some mountain pine beetle work in lodgepole pine. A trip was made up this lake on August 27 and 629 (red-top) Douglas fir trees that had been attacked in 1929 were counted, and from the inaccuracies of such counts one can be assured that there were at least 1,000 trees of this character. Time was not available for the running of sample strip; however, from other such infestations examined there is no reason to expect that the 1930 infestation would be less than the 1929.

McDonald Lake-Douglas Fir Infestation

Around the head of McDonald Lake and extending up the McDonald drainage for several miles, an area traversed by the new Park highway, there is a rather large body of Douglas fir. The stand is not an exceedingly heavy one, and is composed of Douglas fir, larch, hemlock, spruce, and fir, with rather heavy

Douglas fir reproduction. On the south side of this drainage and along the floor of the valley there are some rather heavy stands of lodgepole pine and some scattered white pine. This area lies in a very rough mountainous country, with the steep mountain sides reaching well above timber line.

For several years there has been a small annual loss of Douglas fir in this area as a result of the attacks of the Douglas Fir beetle. In the past two seasons this condition has changed rapidly into a severe outbreak. The destructiveness of this insect and the seriousness of the situation can be plainly seen in the large groups of red-top trees (1929 attacks) scattered along the mountainside.

August 23 was spent by the writer on an extensive examination of this area. Dense underbrush, windfalls, rock slides, etc., with the steep mountain sides, make such areas difficult ones to work. The 1930 attacked trees were very difficult to locate, as the only external evidence of attack lies in the boring dust caught in the crevices of the bark. It is estimated that approximately 12 per cent of the Douglas fir has been destroyed during the past two or three years, and that there are some 700 trees now harboring 1930 attacks of this insect.

At a conference held with Superintendent Eakin and Fire Control Expert Coffman, on August 29, it was decided that control measures should be directed against the outbreak of the Douglas fir beetle at the head of McDonald Lake. For this purpose an allotment of $3,500 was requested. However, funds were not available to meet this request in full and only $2,000 was allotted. This appropriation was not made available until October 4, and though action was immediately taken to start the project, inclement weather was encountered that was a serious handicap to the work. No further recommendations can be made for this project until next season, when the results of the work under way at this time are determined.

At this conference it was decided to abandon the thought of instituting control for the outbreaks of this insect at Logging Lake, as this area is too remote from tourist travel. There are other smaller outbreaks of this insect existing throughout the Douglas fir stands of the Park, and these can be considered in the same light as the Logging Lake epidemic.

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Summary of Recommendations

A summary of the writer's recommendations for the program of control to be instituted in 1931 is as follows:

Writer's Recommendation

Area	Number of Trees	Cost	Control Recommended
McDonald-Mineral Cr.	25-35	$200.00	Yes
Sperry Glacier Trail and Fish Lake	423	1300.00	Yes
Spruce Creek	3015	13,500.00	No
Nyack Region	6400	15,000.00	No
North Fork District (includes Spruce Cr.)	40560 50428	105,520.00 $138,520.00	No

It will be noted that control is recommended for two areas only, calling for an expenditure of $1500. The above tabulation contains in brief the program of control that the writer sincerely believes should be instituted within the Glacier National Park in the spring of 1931. As stated several times within this report, it is desired that these recommendations be critically examined before any one of them are accepted. In the event that it is decided to extend the protection of control measures into the lodgepole pine stands of the North Fork district, the writer has presented three variations to his recommendations, believing that they offer the most plausible plans of operation. It is recommended if this project be instituted that the first of these variations be adopted as offering the greatest assurance of success. However, as these three

plans call for expenditures of funds varying from 110,000 to 25,000, it will be necessary to govern the selection of the plan by the moneys that are available.

If it is desired to do everything possible to protect the lodgepole pine stands of the North Fork, then the following projects should be instituted as a program of control for the season of 1931:

First Variation of Writer's Recommendation:

Area	Number of Trees	Cost
McDonald-Mineral Cr. Basin	25-35	$200.00
Sperry Glacier Trail-Fish Lake	423	1,300.00
North Fork Project	40560	108,520.00
		$110,020.00

As noted, this project calls for the treatment of all infested trees on both the Blackfeet and Glacier portions of the infestation unit, and offers the greatest assurance of success. However, the necessity for follow-up work in 1932, and perhaps longer, with additional expenditures, must be considered. If it is believed that such a project is too large an undertaking to attempt at this time, and it is still desired to make a start in the protection of the North Fork area, then the following plan is the logical one to adopt:

Second Variation of Writer's Recommendation

Area	Number of Trees	Cost
McDonald-Mineral Creek Basin	25-35	$200.00
Sperry Glacier Trail-Fish Lake	423	1,300.00
Spruce Creek	3015	13,500.00
North Fork Lodgepole	30000	51,000.00
		$76,000.00

In the adoption of this plan the threat of reinfestation from the Blackfeet National Forest still exists. If the timber stands at stake are considered of sufficient value to justify this expense in 1931, with the rather safe assurance of additional expenditures for the next few years to come, then perhaps a chance of this character is a justifiable one to take. The plan should be adopted on an assumption that, if required, control measures will be instituted on the Blackfeet portion of the area in 1932. If it is still believed that this is too large a project to undertake, or if sufficient funds are not available, the following plan could be adopted:

Third Variation of Writer's Recommendation

Area	Number of Trees	Cost
McDonald-Mineral Creek Basin	25-35	$200.00
Sperry Glacier Trail-Fish Lake	423	1,300.00
Spruce Creek	3015	13,500.00
		$25,000.00

In this plan the treatment of the Spruce Creek infestation is placed ahead of the lodgepole pine infestation that has been recorded on the North Fork. Though the objective of this project is the protection of the lodgepole pine, it is believed that the elimination of such a source of reinfestation as the S pruce Creek epidemic will prove to be a sounder policy to follow than the expenditure of such a small sum ($13,500) for the cleaning of a small portion of the lodgepole infestation. The adoption of such a plan would of course be under an assumption that control would be instituted in the lodgepole areas in 1932. It is true that under such a plan another year's increase or decrease in the infestation will have occurred before control is instituted. Should an increase occur, a larger appropriation than that estimated for 1931 will be required. However, as the entire area must be covered, the spotting costs will be no higher, and as at this time the infestation is rather light and scattered, requiring a great deal of travel time for a few trees, the actual treating cost might

not be materially greater. Furthermore, the execution of control within an area where each year a reinfestation occurs from such sources as Spruce Creek, etc., results in the project becoming a long-drawn out, expensive operation, and it is believed that better entomological as well as economical results will be obtained if the sources of reinfestation are first eliminated.

Recommendations relative to the institution of control within the North Fork region are extremely difficult to make. The writer's first impulse was to present the entomological need of the problem and to pass the responsibility for determining the economics and advisability of instituting control to the officers of the Park Service. However, there being no desire to evade any responsibility, his reactions, tempered perhaps with too great a consideration of the economics of the situation, have been presented through the recommendations of this report for approval or rejection by the National Park Service. In conclusion, the writer wishes to state that, regardless of the action taken in regard to these recommendations, the Bureau of Entomology will do everything within its power to assist in making any project that is adopted a success.

Respectfully submitted

James C. Evenden
Entomologist